1. INTRODUCTION

NAS-CALC 1 is a column orientated calculator designed to run on a Nascom 1, 2 or 3 microcomputer. It allows an array of columns and rows of data to be created on the display screen. This data can then be edited, saved and printed. Alterations can be made very easily to the data. Relationships between the rows and columns can be defined, so that, for example, the VAT figure can be calculated automatically for rows of sales data. The relationships may be modified at any time and the result of changes to any data or relationships can be immediately calculated and displayed.

NAS-CALC is ideal for handling figures in a 'what if.....' situation, where the effect of a change is to be investigated. The applications for NAS-CALC are almost unlimited. Some examples include:

Balance sheet analysis
Costing
Delivery schedules
Fixed asset register
Forecasting
Investment appraisal
Parts lists
Personnel records
Price lists
Salary data
Sales planning
Scheduling
Tax returns

NAS-CALC can be run on any Nascom computer fitted with at least 24K of user memory. The program can be used with either cassettes or with disc drives using the NAS-DOS disc operating system. A printer is optional, although it is recommended in order to facilitate the presentation of the results.

In this manual we will explain how to install and use the NAS-CALC 1 program. It is assumed that the reader is familiar with the basic use of the computer - the screen, keyboard and disc or cassette operation. If you are not, you should first read the appropriate sections of the Nascom User Guide.

Most users will be supplied with a version of NAS-CALC already configured to suit their Nascom computer. If, however, you wish to run the program on a different system, or you wish to find out how to alter such details as printer type and paper width you should refer to Appendix 1, which contains installation details.

Section 2 of this manual goes on to explain how to start running NAS-CALC. In section 3 an example application is presented, and by working through this you should become familiar with the basic features of NAS-CALC. Subsequent sections of the manual proceed to give a more detailed explanation of all the features and how to use them. Examples are contained in this manual, but to understand the program fully you should try the examples on your own Nascom as you go along.

NAS-CALC is an extremely flexible and powerful package which can be used to solve a wide variety of problems. It is provided with many control options which are invoked by keyboard commands. At first the sheer number of these may seem off-putting, but you will soon find that you become familiar with the system and are able to exploit its many facilities. Never be afraid to experiment - you will find many new applications for the system as you use it.

2. RUNNING NAS-CALC

2.1 Loading and running NAS-CALC

Tape users:

Type

R

and turn on the tape unit to play the first file into the computer. When the file has been loaded type:

E1000

Disc users:

Insert the NAS-CALC disc in disc drive 0 (the right hand drive) and close the door of the disc drive.
Type

]E:NAS-CALC

NAS-CALC will now be operational.

2.2 Re-starting NAS-CALC

If at any time you wish to re-start NAS-CALC completely, deleting all that you have done during a run, you can press the RESET key and then type

E1000

This causes the program to be re-started at memory address 1000, which is known as the 'cold-start address' of NAS-CALC. The same procedure may be used to re-run NAS-CALC if the program is already in memory but you have exited to NAS-SYS to perform some other operation. Note that you can only re-start in this way if you have not modified any of the memory used by NAS-CALC. BASIC, for example, will alter memory used by NAS-CALC.

There is another start address which may be used to re-start NAS-CALC without any loss of data. This can only be used if NAS-CALC is in the computer and neither the program nor the data area have been corrupted in any way. This is known as the 'warm start' address, and is activated by typing

E1003

2.3 The first question

Once NAS-CALC is running you will be prompted by the message

Dimensions?

This is a request for information concerning the number of rows and columns, and the width of the columns, to be used in the current run. As we shall see later this is not an irreversible decision - you can add and delete rows and columns at will later on. However, it is usually easier if you get close to the final requirement at this stage.

If you are running NAS-CALC to load an existing data file the values entered for dimensions will subsequently be ignored. In such cases you can therefore just press the ENTER key, which will cause the default values of rows, columns and width to be selected temporarily.

If you press the ENTER key without specifying the dimensions NAS-CALC will assume initially that there are 10 columns of 12 rows, the width of each column being 8 characters. If you wish to supply a specific value then the entry should be of the form:

Dimensions? **cc,rr,ww**

ie the number of columns followed by a comma followed by the number of rows followed by a comma and finally the columns width. Then press the ENTER key.

Note that the values supplied MUST always fall within the limits given below:

Parameter	Min.	Max.
Columns	3	99
Rows	12	99
Width	3	43

Once you have entered suitable values and pressed the ENTER key (or just pressed the ENTER key if you are selecting the default values) NAS-CALC will enter the command mode.

The commands and procedures are fully described in sections 4 - 7. The next section consists of a worked example of the use of NAS-CALC, and will serve as a useful introduction to the remainder of the manual.

3. USING NAS-CALC - AN EXAMPLE

In this example we will consider a fairly typical application of NAS-CALC. We will use the program to prepare sales predictions for a range of products by month. To avoid controversy these products will be known as widgetts. We have a range of 15 of these products.

Now insert your NAS-CALC disc in the disc drive and start the program. Since we have already prepared the first part of the data for you you can simply press the ENTER key when the prompt Dimensions? appears on the screen. When the blank form appears on the screen type

LOAD EXAMPLE

Note that the keyboard will provide capitals by default when in command mode.

When the file has been loaded you should see the data shown below on the screen, except that the column and row numbers will also be displayed, and vertical lines will appear to separate the columns.

PRODUCT	NET PRICE	PRICE+VAT	Janury
Widgett 1	135.24		250
Widgett 2	65.20		300
Widgett 3	75.99		50
Widgett 4	155.00		150
Widgett 5	125.25		100
Widgett 6	98.00		0
Widgett 7	78.30		100
Widgett 8	279.00		140
Widgett 9	195.90		200
Widgett 10	58.66		160

Now type

EDIT

The flashing cursor will move to the first character of the first row of the first column. Note that the field concerned is bracketed by the [ ] symbols. These are known as the ZONOR. You will find that moving the cursor left and right with the cursor control keys you cannot move the cursor outside the zonor. If you wish to move the zonor you can use the [,], ↑ and ↓ keys. Try using these to move the zonor around the screen. If you press] when the zonor is in the right-most column on the screen the display will automatically scroll horizontally to display more columns to the right. The [and up and down cursor keys behave in a similar way.

For a further experiment try pressing the CH key - this will return the zonor and cursor to the start of the current row. Conversely pressing CTRL and the E key will take the zonor and cursor to the last column of

the current row. Similarly CTRL/G goes to the first row of the current column and CTRL/J jumps to the end of the current column.

Try experimenting with these control keys until you feel familiar with their operation.

If you now return to the first row, column 3, you will see that we have missed out the letter 'a' in January. You should move the cursor to the letter n and press the SHIFT and → keys to open a space in the word - just as you would with the normal Nascom screen editor. If you experiment with the SHIFT/← and BACK keys you will find that these too behave normally. Now move on to the next column and correct the spelling of February (by inserting the missing r). This time you will note that the screen was scrolled across so that the column relating to February appeared on the screen.

The display screen should now look like this:

February	March	April	May	June
180	220	200	180	150
220	300	280	250	200
60	100	150	200	400
150	150	150	150	160
120	120	120	120	130
0	0	0	20	45
100	100	110	120	125
140	140	140	140	140
200	190	180	170	175
160	160	160	160	160

Now go to the first column and go down to insert the headings for Widgett 14 and 15. Note, incidentally, that we can leave blank rows and/or columns (eg row 1) to improve the appearance of the form.

Suppose we now wish to add an additional column to the table, in which we wish to put the total sales for each product for the year. You can do this as follows.

First press the ESCAPE key, which will terminate EDIT mode and return the cursor to the bottom line of the display ready to accept the next command. Now type

ADD [14

This means add a column after column 14 ([means column in this instance). When you press the ENTER key the screen clears and the word LET will appear at the top left of the screen. The reason for this is that altering the column and/or row numbers, which happens whenever you add or delete rows or columns, potentially changes any mathematical relationship which you may have defined in a LET statement. The current value of the LET is therefore displayed as a reminder that you may need to modify it. Just press the ESCAPE key to return to command mode. If

you now type EDIT again and use the zonor control keys you will be able to see that the extra column has been added.

In a similar way you can now add a row after row 16.This will be left blank to impeove the appearance of the display. You should press ESCAPE to leave EDIT mode, then type

ADD]16

(] indicates that the command is referring to a row). Press ESCAPE when the LET message appears in order to revert to command mode.

The purpose of adding the additional column was to put a total for each month in it. Go into edit mode and position the zonor at the top of this new column and type in the heading 'Total'. The display should now appear as follows:-

November	December	Total
220	250	
200	220	
50	40	
160	160	
150	180	
80	100	
170	200	
160	200	
170	200	
180	200	

We now want to tell NAS-CALC to perform the calculation to set the total equal to the sum of the preceding monthly sales columns. To do this proceed as follows:

1. Enter command mode - cursor on the bottom line of the screen (To reach this point press the ESCAPE key if you were in EDIT).

2. Now type LET and press the ENTER key. The screen will clear and the word LET will appear at the top left hand corner of the screen. If any relationship had been defined already this would also have been displayed, and could be edited using the cursor control keys in the normal way.

3. Type, immediately after the word LET,

[15=[3:14

The [symbol refers to columns. The ':' symbol should be read as 'to', and in this context means, by default, add. Therefore the LET statement means

Let column 15 equal the sum of columns 3 to 14.

Now press the ENTER key to enter this equation into the computer. You

can now press the ESCAPE key to exit from LET mode and revert to command mode.

The new relationship which you have defined will not yet be executed. To perform the equation, and to display the result, you must re-enter EDIT mode - just type EDIT and press the ENTER key. Now move the zonor so that you can see the last column (you can use the CTRL/E keys to get straight to the last column). What a disappointment - there is still no answer in the last column! The reason is that the calculations are only performed when the ENTER key is pressed in EDIT mode. Now do this, and the screen should become as shown below.

November	December	0 Total 0
220	250	2240
200	220	2610
50	40	3020
160	160	1870
150	180	1570
80	100	495
170	200	1585
160	200	1790
170	200	2165
180	200	1970

The reason for deferring calculations until the ENTER key is pressed is that when very complex mathematical relationships are specified the time taken to perform them can become significant. Therefore rather than have them executed every time you change some data, with a consequent delay, the computer waits for you to specifically request the results to be computed by pressing the ENTER key when you are in EDIT.

There is one snag in what we have done - the heading Total has got over-written. This is only to be expected, as we asked for ALL the values in column 15 to be set equal to the sums of the preceding columns. The sum of the characters (non-numeric data) in the columns of row 0 is 0, and that result is displayed. We can overcome this in two ways. The first would be to precede the word Total with a ! character, which will protect it from being re-calculated. Alternatively, and more generally, we could modifiy our LET statement to define which rows we wish to perform the calculation on. If we exit from EDIT (press the ESCAPE key) and type LET and press ENTER again we can use the cursor control keys to change the LET statement to read

```
LET [15,2:16=[3:14
```

The additional comma indicates that we wish to add row information, and 2:16 means 'evaluate the expression on rows 2 to 16 only. If you now press ENTER to enter this new equation, escape form LET and enter EDIT mode, you can re-type the heading Total. Now if you press ENTER the calculation will be performed again, but this time the word Total should be unaffected.

You can put more than one LET statement in at any one time, and the range of operations which can be specicifed is very wide. Suppose we wish to calculate the VAT inclusive prices in column 2. Can you work out how to do this - have a think before reading the explanation below.

First you should get out of EDIT by pressing the ESCAPE key, and then type LET and press the ENTER key to enter LET mode. The current LET statement will be displayed,ie

LET [15,2:16=[3:14

We wish to leave that definition alone and add another. We do this by moving the cursor to the position after :14 using the -> key. Now type a semicolon to indicate the end of the first definition and then type

[2,2:16=[3*1.15

Note that we again only want to perform the calculation on certain rows ie not on the headings! The total LET statement should now appear as

LET [14,2:16=[3:14;[2,2:16=[3*1.15

Press the ENTER key to save the new equation and hen press ESCAPE to return to command mode. Typing **EDIT** will revert to EDIT mode, and finally ressing the ENTER key will cause the VAT inclusive prices to be calculated.

You can specify relationships between rows in a similar way.

You can now use NAS-CALC to determine very quickly how the annual sales will change if we revise the estimates on a number of items. Suppose that se decide January sales of widgett 1 will only be 120 and March sales will drop to 140. Move the zonor to the appropriate positions and change these figures accoridngly. Now all you have to do is press the ENTER key and the previously defined equations will be re-claculated and the totals will be changed accordingly - have a look if you don't believe us!

We could now save the revised example by returning to command mode (ESCAPE from EDIT) and typing

SAVE EXAMPLE2

If we had used the old name EXAMPLE NAS-CALC would have asked us if we wished to overwrite the existing file - an answer Y causes overwriting, any other character results in the SAVE being aborted.

There are far more facilities available than have been described in this simple demonstration. We suggest that you scan through the manual in full to start with, but don't attempt to memorise all the facilities at once. Content yourself with knowing what can be done, and then refer to the manual to find out how to do it when you need to use the facility. You will soon find that you become familiar with the features, and will need to refer less and less to the manual.

The final feature we will show in this demonstration concerns the use of the printer - if you haven't got a printer yet you can skip this.

If you go into EDIT mode and press the CTRL and X keys the contents of the screen will be sent to the printer. To print the entire array of data you could type

PRINT]0

which will cause all the columns to be printed starting from row zero. If the width of the paper is exceeded the extra columns are printed below the right-most column. Alternatively you could deliberately restrict the printing to columns 0 to 6:

PRINT]0,0:6

The PRINT command is fully described in section 4.2 of this manual.

4. NAS-CALC COMMANDS

When you have specified the dimensions after a cold start of NAS-CALC, or you perform a warm start, or press ESCAPE in edit mode the NAS-CALC program enters what is known as command mode. The flashing cursor will be positioned on the bottom line of the display. In this mode you can type in a variety of commands, which are described below. You MUST press the ENTER key after each command to cause it to be performed.

The commands available in NAS-CALC are described below. They have been divided into 4 groups:-

Data storage and loading
Printer control
Data manipulation commands
Other commands

Within these groups the commands will generally be described in alphabetical order.

Note that some commands need to specify arguments, that is the rows and/or columns to which they apply. The rules governing the definition of these arguments are dealt with in section 6 of this manual.

4.1 Data storage and loading

DIR (Disc users only)
This causes the directory of the current disc to be displayed.

DISC (Disc users only)
This command specifies the disc drive number to be used in subsequent disc-based commands.

LOAD filename
1. Disc users - The file name specified will be loaded from disc. Any existing data will be over-written.
2. Cassette users - The named file will be loaded from cassette. If a non-matching name is found it will be printed out and followed by a question mark whilst the program continues searching for the correct one. You can interrupt the loading at any time by pressing the ESCAPE key four times, but you should not do this once actual data has been read to the memory as this may cause false dimensioning and a program failure. If no name is given the program will load the first file it finds on the tape.

SAVE filename
1. Disc users - This command will cause the current data file to be saved on disc with the name filename. If the file name already exists an "Overwrite?" message will be displayed. Type Y to overwrite, or any other character to abort the save operation.
2. Cassette users - This will cause the entire contents of the current matrix to be written to cassette under the name given. The name may be up to 10 characters long and may not contain graphic or control characters.

VERIFY filename
As for LOAD from cassette, except that the program is simply checked for readability and the process may be interrupted with impunity.

4.2 Printer control

LINES n
Sets the number of lines per page for printer output.

MARGIN n
Sets the left margin width for printer output.

NAME (string)
Sets the name to be printed at the top of printed pages. If no string is given then the current name is printed out.

PRINT (args)
This is the main print action command. The contents of the areas specified by the arguments are sent to the printer. For details of the use of the arguments see section 6 of this manual. The arguments may be any of the four basic ROW types only and you may use multiple arguments separated by semi colons. Column arguments may not be used although printing by column rather than row is achieved as follows. For example:

```
PRINT ]4,3:7
```

will print columns 3 to 7 starting from row 4 and continuing until the last row.

When printing by rows all columns are printed. Thus if you have 9 columns

```
PRINT ]0:11
```

will print all nine columns starting from row 0 and ending at row 11.

If, during printing by rows, the width of the printer is exceeded then the extra columns are printed below the rightmost column. The print width is internally initialised and may be modified as described in Appendix 1 of this manual.

4.3 Data manipulation commands

The commands for moving and manipulating data all use arguments, which specify the rows and columns referred to. For details of the interpretation of row and column arguments you should read section 6 of this manual. Note that since some of these commands would potentially require an alteration of the LET statement the LET command is automatically invoked after such commands to remind the user to carry out the necessary changes to the LET.

ADD]n
Will insert a new row after row n thus increasing the matrix size by one row. Columns may be added similarly by:

ADD [n
Several arguments may be given separated by semicolons. Thus:

ADD]2;]2;[3
will insert two new rows after row 2 and a new column after column 3.

Adding effectively increases the size of the matrix by the requisite number of rows or columns. You should specify the lowest or rightmost operation first. Both ADD and DELETE normally exit by printing out the current LET expression for modification.

CLEAR (args)
Sets an element or a group elements to all spaces. The argument may be any of the above. Several arguments may be given, separated by semi colons. For example:

CLEAR [3;]2:4

will clear out all of column 3 and then all of rows 2, 3 and 4.

COPY (args)
Copies the contents of one row to another, or one column to another.

COPY [3:5
Would copy the entire column 3 to column 5. Note the use of ":" to mean "to" in this case. You may use multiple arguments as in CLEAR.

COPY]2:7
Copies all of row 2 to row 7.

DELETE]n
This will completely remove row n and close up others over it. Thus, deleting row 4 will cause the former row 5 to become row 4. This action is the exact opposite of ADD when the former row 5 would, for example, be down scrolled to become row 6.

As with ADD you can only specify a single, whole row or column and can use several arguments. Eg:

DELETE]7;]7;]2;[3

would delete rows 7 and 8 (remember the former row 8 became 7 after the first delete 7) then row 2 and lastly column 3.

Deleting effectively reduces the size of the matrix by the requisite number of rows or columns. As with ADD you should specify the lowest or right-most operation first. Both ADD and DELETE normally exit by printing out the current LET expression for modification.

LET
The LET command is used to specify the relationship between various pieces of data. It is fully described in section 8 of this manual.

LJ or RJ (args)
This causes the contents of the specified elements to be left (or right) justified.

LJ or RJ (no args)
Causes all result values to be right or left justified during calculation. Note that RJ automatically sets "WIPE" mode.

4.4 Other commands

DOS (Disc users only)
This command terminates NAS-CALC and causes a return to the NAS-DOS disc operating system.

MON
Executes a return to the NAS-SYS operating system. Note that links between NAS-CALC and NAS SYS are not severed; therefore if you do not intend returning to NAS-CALC type ED and press the ENTER key.

NEW c,r,w
This will re-dimension the matrix as if from a cold start. The same rules apply as for the "Dimensions?" prompt.

CHAR x
Sets a single character to preceed all printed results and be ignored by the arithemetic routine. This would normally be "£" or "$". DO NOT use alphabetic characters if you intend using variables. If no character is given then the existing one is cancelled.

EDIT
This command invokes edit mode. The edit operations are fully described in the next section of the manual.

NORM
All arithmetic results in NAS-CALC 1 are placed in the array and then displayed as necessary on the screen. However, there is a trade-off involved between neatness and speed in that the arithmetic routine is happy to output its results to an element already filled with other data without clearing it first. The process of clearing all receiving elements before outputting a result can slow the program down in a large array of data, so that normally this is not done. This is the normal output condition and is defaulted to at start up. The clearing process can be invoked with WIPE and will cause all target elements to be cleared before outputting the results.

WIDTH c,w
Sets the width of column number c to w characters. Note that all elements in a given column are of the same width. Both c and w should be in decimal. No checks are made for data loss when the column is being made narrower.

WIPE
See NORM.

5. NAS-CALC EDITING FEATURES

Edit mode is invoked by typing the command EDIT in command mode. The keyboard is automatically placed in typewriter mode - ie lower case, with the shift key being used to produce upper case characters.

The cursor will move to the point where it was positioned after the last edit, or in the top left hand corner of the data array if this is the first edit operation. A graphic enclosure [ ] is used to indicate clearly the data element which is currently being edited. This enclosure will be referred to as the 'zonor' in this manual. During editing operations the flashing cursor will always remain within the zonor until edit mode is terminated.

The editing commands, including those to move the cursor and the zonor, are described below. Note that the ENTER key is not needed during normal editing - indeed it has a special function, which will be described later.

5.1 Cursor and zonor controls

Right/Left arrow
These move the cursor right or left within the zonor.

Shift plus right/left arrow
These operate as normal, moving the text one position to the right or left from the current cursor position.

Cursor home (CH)
Normally returns the display to start at column zero and moves the zonor to the column zero entry for the line which it was on when CH was typed.

Backspace (BACK)
Deletes the character at the cursor and moves the cursor back one character unless it is at the left hand end of the element.

] (close brace) and [(open brace)
These move the zonor and cursor (NOT just the cursor) right and left respectively. When the zonor is at the right hand side of the screen typing "]" will normally move it to the left hand side with the column which was formerly off the screen to the right. When the zonor is at the left hand side of the screen "[" will scroll the display right to reveal the column which was formerly off the left hand side of the screen.

Up/Down arrow
These move the zonor and cursor up and down. When the zonor is at the bottom of the screen down-arrow will scroll the display up to reveal the line which was formerly off the bottom of the screen. Similarly, up-arrow will scroll the display down if the zonor is on the top line.

Ctrl/D
Diminishes the column width by one character.

Ctrl/E
Places the zonor on the last column of the current line.
(End of line)

Ctrl/G
Normally returns the zonor to the line zero entry for the current column.
(Go to first line)

Ctrl/J
Places the zonor on the last line entry for the current column.
(Jump to last line)

Ctrl/K
Clears the entry enclosed by the zonor to all spaces.

5.2 Display control

The next four control characters enable "fold over" of columns or rows. That is, they free the user from necessarily having to view only consecutive rows or columns. For example, at start up the top line of the display shows consecutive column numbers from zero on the left to say, five on the right. But if you need to see columns 0, 1,2,6,9 and 11 then you will need the fold over functions. These are:

Ctrl/B
Horizontal BACK fold. This scrolls the display right from the zonors point to reveal columns between the zonors original column and that to the left of it. Thus if the zonor's column is number 9 and the one to the left is number 5 then Ctrl/B will reveal column 8. Once there are no further hidden columns between the zonor's column and the one to the left of it Ctrl/B will be ignored.

Ctrl/F
Horizontal FORWARD fold. This scrolls the display left from the zonor's column. If the next column is too wide to fit on the portion of the screen right of the left end of the zonor then Ctrl/F will be ignored and you will need to move the zonor left and try again.

Ctrl/N
Vertical forward fold. This scrolls the display below and including the zonor's line up to reveal the line which was formerly off the bottom of the screen. If the bottom line of the screen is displaying the lst line in the matrix then Ctrl/N will be ignored whichever line the zonor is on.

Ctrl/P
Vertical back fold. This scrolls the display below and including the zonor's line down to reveal any hidden lines between the zonor's line and the one above it. If there ae none then Ctrl/P will be ignored.

5.3 Other control characters

ENTER key
Pressing the ENTER key causes execution of all the calculations specified in the LET statement. There may be a short delay after pressing this key, depending how many and how complex the relationships specified in the LET statement are.

ESCAPE (Shift/ENTER)
Causes a return to command mode.

! (exclamation mark)
This is not a normal "function" character but when used as the first character in an element it acts as a write-protect in that no results of any kind wll be output to the element. Exclamation marks, wherever they occur, will never be printed and are replaced by a space in the printout.

?(query)
This too is not a normal function character. It may be used in place of a value which is unknown or irrelevant. All results depending upon the value will be evaluated as "?".

Ctrl/A
Switches the graphic lines on.

Ctrl/C
This interrupts the normal editing process to provide a number of special functions. It causes the program to wait for a sequence of keys to select the function. The keys should be typed one after the other. In the following "arrow" refers to any of up/down/left/right arrow.

Ctrl/C then C
Replaces the current contents of the element by its current value.

Ctrl/C then x then arrow then i or t or ENTER
where x is one of GLSA and i or t are format characters described under LET. GLSA stand for greatest/least/sum/average. The arrow indicates which direction the calculation will follow. For example, if the zonor is at row 9, column 4:

Ctrl/C G up-arrow i
Will print (as an integer) the greatest value that can be found from all the valid entries in column 4 above and including the zonor's element.

Ctrl/C A right-arrow
Will return the average of all valid entries in row 9 from, and including, the zonor's element to the rightmost entry in row 9

Ctrl/C then H then y
Where y is one of CRBO. The H function holds the leftmost column or topmost row in its current place on the screen. CRBO stand for Column/Row/Both/Off. For example, if column 6 is the leftmost visible column then:

Ctrl/C H C
Will lock the screen so that it is impossible to move column 6 from the left hand side. "Both" locks the top row and leftmost column whilst "Off" cancels any lock. Note that some ofo the editing functions become slightly modified. For example CH returns the zonor to the leftmost column, not necessarily column zero. You will also need to make more use of Ctrl/BFPN.

Ctrl/L or Shift/backspace or Graph/Q
Toggles the keyboad shift lock.

Ctrl/O
This switches the graphic lines separating the fields off.

Ctrl/X
This will cause the entire current contents of the screen to be sent to the printer. Typing ESC (SHIFT/ENTER) will interrupt the process.

6. SPECIFYING ARGUMENTS, RELATIONSHIPS AND VARIABLES

The relationship between data in various rows and columns of the matrix is specified using the LET command. The use of this command is discussed in section 7 of this manual. The relationships used in the LET statement and other commands using arguments follow the rules given below.

X = n

Assigns the value n to variable X. NAS-CALC 1 recognises 26 variables - A to Z. They can only be assigned in command mode but may be referenced anywhere in the array.

X =
The value of variable X is printed.

When specifying relationships between rows and columns of data the following methods are used to specify which data elements are being referred to.

The two characters used to refer to rows and columns are:

[Open-square-bracket for columns
] Close-square-bracket for rows.

In most instances these are used with an argument or arguments to indicate one of:

1) A single, whole column or row.

2) A single element within one column or row.

3) A consecutive set of columns or rows.

Below are listed the four basic constructions, the numbers are only examples. First, columns

[3
Refers to all entries in column 3.

[3,6
Refers to the single entry at column 3, row 6.

[3,6
Refers to all entries in each separate column from columns 3 to 6.

[3,6,10
This refers to column 3, lines 6 to 10.

Similarly, for rows:

]3
Refers to all entries in row 3.

]3,6
Refers to the single entry at row 3, column 6.

]3:6
Refers to all entries in each separate row from row 3 to row 6.

]3,6:10
Refers to row 3, columns 6 to 10.

The separators , ; and : are generally used as follows:-

,	Separates column arguments from row arguments
:	Specifies the range within which an argument is to be applied
;	Separates several different sets of arguments or expressions which are being typed on one line.

7. THE LET COMMAND

7.1 The LET expression

This is the command which assigns the relationship between rows or columns. It has the form

LET (expr)

If (expr) is omitted then the entire current LET expression will be printed out with the cursor placed at the start of it. As the expression may be up to 15 lines long the whole screen is used. Normally, to assign a LET expression at start up, use LET. This will blank the screen and prompt with LET at the top left hand corner. Note that any text or alterations you type in are NOT ENTERED in to the main buffer until you press the ENTER key. All the normal Nascom screen editing is available but note that Shift/right and left arrows both operate in full wraparound. To return to command mode use the ESCAPE (Shift/ENTER) key.

If you follow the LET command with an expression, for example:

LET [3

then the whole current LET expression will be printed out as above, but the cursor will be placed on the first occurrence of a direct reference to column 3 - if one can be found. If none can be found then the message "CF" (Can't Find) will appear. If an occurrence was found then by typing Ctrl/C (continue search) further occurrences will be located until no more can be found when Ctrl/C wll be ignored.

LET operates rather like its counterpart in BASIC, in that the first part of the expression essentially represents a target for the results of the part following the "=" sign. However, in the case of NAS-CALC it is a number of targets which are specified.

The first part of the expression may be any of the four basic constructions. Eg:

LET [3 = ...

Specifies that something be done to each entry in column 3. It is at this point that it is necessary to explain that column or row arguments implicit in the first part affect the second part. For example LET [3 implies ALL ROW entries in column 3. Thus:

LET [3 = [0

implies all of column zero since the first part refers to all of column 3. This expression would in fact set each line entry of column 3 to an exact copy of the line entry from column 0.

It should now be apparent that if you have say, 20 rows then:

LET [3,0:19 = [0

Would perform the same function as:

```
LET [3 = [0
```

Since in each one ALL of column 3 is specified which causes ALL of column 0 to be implied.

A more useful construction might be:

```
LET [3 = [0 + 2
```

Which would set each row entry in column three to 2 + the row entry in column 0.

You are not restricted to only one row or column expression in the right hand side. The example at the start of the editing instructions was:

```
LET [3 = [0 + [i
```

This sets each row entry in column 3 to be the sum of the row entries in columns 0 and 1.

The next step is to specify a certain number of entries from a row or column if you don't need all entries. Here the other types of basic construction may be used. For example:

```
LET ]8,3:6 = .....
```

Specifies column entries 3 to 6 in row 8 as targets for something. Here, as the expression is dealing with a row which you have limited to a few columns, any row expressions following the "=" will be assumed to be limited to those same columns. Thus:

```
LET ]8,3:6 = ]6+]7
```

would set each of the entries 3 to 6 in row 8 to be the sum of the same column entries in rows 6 and 7. Note that the construction "n,x:y" may NOT be used to the right of the "=" sign.

Another example of implicit arguments is:

```
LET ]13:8 = ]0:3
```

which specifies that in row 13, entry 8 is to be the sum of the eighth entries in rows 0 to 3. Note that the use of ":" right of the = sign means SUM OF.

It is perhaps best to give now a set of standard constructions which will cover all combinations:

```
LET ]7 = ]6 + 1
```

Each entry in row 7 shall be 1 + the corresponding entry in row 6.

```
LET ]7,2 = ]0:3
```

The single entry at row 7, column 2 shall be the sum of the column 2 entries in rows 0 to 3.

LET]7,2:4 =]0:3
Each of the column entries 2 to 4 in row 7 shall be the sum of the corresponding column entries in rows 0 to 3.

LET]7,2:4 =]1:3
Rather useless, but sets each of entries 2 to 4 in row 7 to the same as that at row 1 entry 3.

The column constructions are handled similarly. Note that the construction "x:y" cannot be used to the left of the "=" sign since it is meaningless in this position.

The expressions may contain any of the arithmetic operators, thus:

LET [2 = ([1↑2)/[0
sets each entry in column 2 to be the square of the column 1 entry divided by the column 0 entry.

A single expression may only refer to rows or columns - not both. Eg:

LET [3 =]2
is both meaningless and illegal.

You may use multiple arguments separated by semicolons Eg:

LET [3 = [1 + 1 ;]2 =]2/3

Lastly, any element may contain names or titles or any general non arithmetical data but be sure to exclude say, a first row consisting of titles, from any relationship expressions.

7.2 Formatting

There are three output formats available for results. These are represented by "i" (Integer), "t" (Truncated) and "g" (Graph). The letters i t and g must be inserted immediately after the = sign(s) in the LET expression. "g" may optionally be followed by a scaling argument. All graph result values are multiplied by this value before they are output. For example:

LET [2=g 1*3

Would set all entries in column 2 to be the graph of 3* the column 1 entry whilst:

LET [2=g0.5 [1*3

Would cause each result to be multiplied by 0.5 before being output as a bar graph.

LET [2=+ [1

Would return the column 1 entries truncated to three decimal places. The truncated format always provides three, and only three, decimal places whilst the integer (i) format truncates to an exact integer.

7.3 The arithmetic unit

This operates to twelve digits in normal, BASIC style mantissa and exponent form. The exponent may be specified between E+ - 99 although larger results can be printed out with exponents up to +- 127. Such results would not properly be re evaluated as the exponent routine only looks for two digits.> Therefore do not make a habit of forcing such colossal results.

The operators and their priority are:

( ) Brackets evaluated first.
- Negation.
↑*/ Exponentiation, multiply, divide - all equal priority.
+- Plus minus.

Built in constants are:

pi returns 3.1415926536
e returns 2.71828182

The exponential routine returns a twelve digit result where integer powers are involved and a seven digit result,normally accurate to seven places, where a fractional power is involved.

During the process of outputting results the program will attempt to expand a column to fit the answer in only if:

1) The integer portion won't fit.
2) The exponent won't fit.

Fractional parts are simply not output if they won't fit.

8. ERROR MESSAGES

These appear as a flashing pair of letters on the command line. They are:

BS
Bad subscript. As in BASIC you have referred a non existent column or row.

SN
Syntax error. Usually caused by an error in the LET statement or, in command mode, by illegal arguments for a command.

AD
Arithmetic overflow. Only during calculation functions.

?0
Divide by zero error.

CF
Can't find. A search of the LET buffer has failed to find the expression you specified.

EM
End of memory. During re-dimensioning indicates that the matrix you have requested will not fit the memory. During calculation it indicates that the arithmetic unit failed to expand a column to fit a significant portion of a result.

Mis-spelt or illegal commands cause a flashing graphic block to appear.

APPENDIX 1 - INSTALLATION OF NAS-CALC

Most purchasers of NAS-CALC should have been supplied by the dealer with a version of the program already configured to suit their Nascom computer. If you are in any doubt about this you should consult your dealer. If your NAS-CALC is already configured to suit your computer you may ignore the remainder of this section of the manual.

The information given below is primarily of interest to the user who is familiar with the use of the Nascom computer and who wishes to modify the system configuration in some way.

1. Computer hardware requirements

In order to use NAS-CALC you need the following items in your computer system:

Nascom 1, 2 or 3
24K minimum user memory.
Video monitor or TV with lead.
Either Cassette tape recorder and leads
or Nascom single disc drive and NAS-DOS disc operating system

The program will work with up to 60K of user memory - the more memory you have the more data you wil be able to handle. More than one disc drive may be fitted to the system, but the NAS-DOS operating system is essential.

2. Configuring NAS-CALC for different printers

If your system is fitted with a printer you may need to load an additional file to configure the program to suit this printer. As supplied NAS-CALC is suitable for use with a serial (RS232) printer. If your printer uses a parallel interface you should load the file CALCPAR from disc (first file on the second side of the tape cassette) after loading NAS-CALC. If you save the resulting program the support for your printer will be permanently incorporated. To save the program type

```
]O:NAS-CALC:1000 3ED0 1000        (Disc users)
or W1000 3ED0                     (Cassette users)
```

If you wish at some point in the future to revert to a serial printer you can load the file CALCHAND (or the second file on side 2 of the tape) after loading NAS-CALC.

If you are using some other type of printer you can do this by incorporating a routine to drive the printer at location 1068 hex. To assist in doing this source listings and source files for the existing serial and parallel printer drivers are provided in this manual and on the disc. If you are in any doubt regarding your printer please consult your supplier, who will be happy to advise you.

3. Setting the paper width

NAS-CALC is supplied configured for a printer with a paper width of 79 columns. The width of the paper can be changed by first loading NAS-CALC, entering NAS-SYS and modifying memory location 10E9 to contain the required width. For example, if you wish to set the paper width to 131 you would type

```
M10E9
83.
```

Note that the with is specified here in the hexadecimal notation - 83 hex = 8 * 16 + 3 = 131 decimal. Similarly if you wished to set the width to 80, 80 is equal to 5 times 16 plus zero, so the number entered should be 50.

You can then save the modified version of NAS-CALC to make this change permanent by typing

```
    ]O:NAS-CALC:1000 3ED0 1000      (Disc users)
or  W1000 3ED0                      (Cassette users)
```

4. Installation with a non-standard NAS-DOS system

If you are in the unusual position of having your NAS-DOS disc operating system located at some point other than D000 hex (the standard) you should modify the program by means of the folowing comands:

```
M105D
n8.
M1060
n0.
```

where n is the field number at which the NAS-DOS is located.

If you have purchased a cassette version of NAS-CALC and subsequently wish to use it with NAS-DOS you should modify two memory locations as follows:

```
M10CF
0 0.
```

Conversely if you wish to use a disc version of NAS-CALC with tape output/loading you should modify the locations as follows:

```
M10CF
18 5.
```

You can now save the modified NAS-CALC on disc by typing

```
]O:NAS-CALC:1000 3ED0 1000
```

or on cassette by typing

```
W1000 3ED0
```

5. NAS-CALC with the Nascom 1

NAS-CALC contains a keyboard repeat feature which will cause a key which is being held down to repeat printing after a short initial delay. This is only used when the computer is fitted with the NAS-SYS 1 monitor, since the NAS-SYS 3 monitor already has a keyboard repeat feature. Some Nascom 1 machines fitted with NAS-SYS 1 may exhibit keyboard bounce. If this happens you should type the following

```
M103F
3A 9 C.
M1047
E6 20 32 9 C.
```

You can then save the modified version of NAS-CALC in the same way as has been described in previous sections of this appendix.

APPENDIX 2. DISC CARE AND BACK-UP

Discs should be treated with care to avoid damage. NEVER:-

1. Bend the disc
2. Stand any object upon it
3. Write on the label of the disc with other than a felt or fibre tipped pen
4. Subject it to heat
5. Place it in close proximity to magnetic fields.

You should also never turn the computer or disc drives on or off with the disc in the disc drive without at least opening the door of the disc unit first.

If you take these precautions you should find that the life of discs is very long - in fact you may never have any failures of discs. However, Murphy's Law states that anything that can go wrong will go wrong, and you should always assume that this law is in effect. You should therefore regularly make copies of your data discs and store these in a safe place, so that if a disc is damaged or corrupted you are able to recover reasonably up-to-date data. A further effect of Murphy's Law is that if you take these precautions you are less likely to 'lose' a disc anyway!

You should follow the steps below in copying ('backing-up') your discs.

1. Make sure you have terminated any current program normally.
2. Insert the 'master' disc (the one you want to copy) in the left hand drive, drive 2. Insert the disc on which you want to make the copy in the right hand drive, drive 0. If the disc on which the copy is to be made has never been used before you must first format it. To do this type]F0:name: and press the <ENTER> key. You can give the disc any name of up to 8 characters. Now type Y when the computer asks if you are sure, and press 2 when you are asked for the skew. Wait for formatting to complete.
3. Your master disc should contain a copy of the program COPYDD - if it did not insert the 'UTILITIES' disc in drive 2 for step 4 below, and then replace the master disc before step 5.
4. Type

```
]E2:COPYDD
```

and press the <ENTER> key. A message will appear to show that the disc copy utility is running, and the computer will request the source and destination disc numbers.
5. Type 2,0 and press the <ENTER> key. The computer will display the name of the source anddestination discs. If these are correct press the <ENTER> key.
6. The computer will display the number of each track on the disc as it performs the copy. On completion you may verify the new disc using the VERIFY program, either from the master or destination disc, or if you do not have VERIFY on the master disc you could load the UTILITIES disc into the left hand drive. In either case the verification is initiated by typing

```
]E2:VERIFY
```

and specifying disc number 0 when requested.

When you are copying a disc NEVER copy onto your last back-up disc - if you do and a disaster occurs you will lose not only your current disc but also your back-up. Security can be increased by keeping several back-ups, and 'rotating' these so that you always copy onto the oldest back-up disc. If you keep two copies you would copy on day one to 'Back-up 1', on day two to 'Back-up 2', on day three to 'Back-up 1' again, and so on.

APPENDIX 3. PRINTER DRIVER ROUTINES

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```
                    0000 ;SERIAL PRINTER DRIVER FOR CREATOR & NAS-CAL
                    0001 ;-----------------------------------------
                    0002 ;
                    0003 ;REV 1.4      6 JULY 1982
                    0004 ;
                    0005 ;COPYRIGHT (C)1982 LUCAS LOGIC LIMITED
                    0006 ;
                    0007         ORG     01029H
                    0008 ;
                    0009         ENDS
                    0010 ;
                    0011 ;PRINTER INITIALISER
                    0012 ;
1029 E5             0013 HANDS   PUSH    HL ;SAVE REGISTER
102A 21 34 10       0014         LD      HL,HANDR ;SET USER ROUTINE IN U
102D 22 78 0C       0015         LD      (0C78H),HL
1030 DF 55          0016         SCAL    "U" ;ENABLE PRINTER ROUTINE
1032 E1             0017         POP     HL ;RESTORE REGISTER
1033 C9             0018         RET
                    0019 ;
                    0020 ;CHARACTER OUTPUT ROUTINE
                    0021 ;
1034 F5             0022 HANDR   PUSH    AF ;SAVE CHARACTER
1035 DB 00          0023 HERE    IN      A,(0) ;WAIT TILL FREE
1037 E6 80          0024         AND     080H
1039 28 FA          0025         JR      Z,HERE
                    0026 ;
103B F1             0027         POP     AF
103C DF 6E          0028         SCAL    06EH ;PRINT IT
103E C3 05 D4       0029 EXIT    JP      0D405H ;RETURN TO DOS
                    0030         SUPP
```

```
                        0000 ;PARALLEL PRINTER DRIVER FOR CREATOR & NAS-CAL
                        0001 ;-------------------------------------------
                        0002 ;
                        0003 ;REV 1.5     6 JULY 1982
                        0004 ;
                        0005 ;THIS ROUTINE IS FOR USE WITH PRINTERS
                        0006 ;USING A PARALLEL, CENTRONICS, TYPE OF
                        0007 ;INTERFACE, CONNECTED VIA THE PIO.
                        0008 ;
                        0009 ;THE CONNECTIONS SHOULD BE MADE AS
                        0010 ;DESCRIBED IN APPLICATIONS NOTES AN-005
                        0011 ;AND AN-006.
                        0012 ;
                        0013 ;THE MAIN DRIVER ROUTINE IS LOCATED AT
                        0014 ;THE BEGINNING, AND CONFIGURES THE PIO
                        0015 ;EACH TIME IT IS CALLED
                        0016 ;
                        0017 ;*****************************************
                        0018 ;
                        0019 ;MAIN DRIVER
                        0020 ;
                        0021         ORG     0
                        0022 PORTA   EQU     4 ;PIO PORT ADDRESSES
                        0023 PORTB   EQU     5
                        0024 CONPTA  EQU     6
                        0025 CONPTB  EQU     7
                        0026 ;
                        0027         ORG     01029H
                        0028 ;
                        0029         ENDS
                        0030 ;
                        0031 ;CONFIGURE THE PIO PORTS
                        0032 ;
1029 F5                 0033 CONFIG  PUSH    AF ;SAVE REGISTERS
102A E5                 0034         PUSH    HL
102B 3E CF              0035         LD      A,0CFH ;PORT CONFIGURATION
102D D3 06              0036         OUT     (CONPTA),A
102F 3E FD              0037         LD      A,0FD ;MAKE ALL PORT A BITS INPUT
1031 D3 06              0038         OUT     (CONPTA),A ;EXCEPT 1 (STROBE)
1033 3E 02              0039         LD      A,02H ;SET STROBE LINE
1035 D3 04              0040         OUT     (PORTA),A
1037 3E 0F              0041         LD      A,0FH ;PORT B IS OUTPUT
1039 D3 07              0042         OUT     (CONPTB),A
103B 21 46 10           0043         LD      HL,CENTP ;SET THE 'U' VECTOR
103E 22 78 0C           0044         LD      (0C78),HL
1041 DF 55              0045         SCAL    "U" ;ENABLE U ROUTINES
1043 E1                 0046         POP     HL ;RESTORE REGISTERS
1044 F1                 0047         POP     AF
1045 C9                 0048         RET
                        0049 ;
                        0050 ;MAIN DRIVER TO OUTPUT CHARACTER
                        0051 ;
1046 F5                 0052 CENTP   PUSH    AF
1047 DB 04              0053 CP1     IN      A,(PORTA) ;CHECK IF BUSY
```

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```
1049 1F          0054          RRA
104A 38 FB       0055          JR      C,CP1 ;WAIT TILL FREE
                 0056 ;
104C F1          0057          POP     AF
104D F5          0058          PUSH    AF
104E D3 05       0059          OUT     (PORTB),A
1050 CB CF       0060          SET     1,A ;STROBE THE DATA OUT
1052 D3 04       0061          OUT     (PORTA),A
1054 AF          0062          XOR     A
1055 D3 04       0063          OUT     (PORTA),A
1057 2F          0064          CPL
1058 D3 04       0065          OUT     (PORTA),A
105A F1          0066          POP     AF
105B C9          0067          RET
                 0068          SUPP
```

PB=5

PA=4

51 BYTES.

1029 to 105B

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